



# First survey of the amphibians and reptiles of the Nectandra Cloud Forest Reserve, Alajuela, Costa Rica

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**Abstract:** We conducted a first survey of the amphibians and reptiles of the Nectandra Cloud Forest Reserve in June 2010, during the rainy season in Costa Rica. We found a total of 30 species of amphibians and reptiles in 15 families during our weeklong survey, including 15 frogs, 2 salamanders, 7 lizards, and 6 snakes. We compare our results to those of a previous survey of the nearby San Ramón Reserve.

**Key words:** Costa Rica, herpetofauna, amphibians, reptiles, Mesoamerica

## INTRODUCTION

Despite its relatively small area (51,100 km<sup>2</sup>), Costa Rica is rich in amphibians and reptiles. One hundred and ninety-nine species of amphibians (AmphibiaWeb 2014) and 241 species of reptiles (F. Bolaños, pers. comm.) are reported from the country, and new species continue to be described (García-París et al. 2008; Chaves et al. 2009; Boza-Oviedo et al. 2012). While some parts of the country are well known biologically, especially reserves such as La Selva (Guyer and Donnelly 2004) in the northern lowlands, Monteverde Cloud Forest Reserve in the Cordillera de Tilarán (Hayes et al. 1989), Reserva Biológica Alberto ML Brenes near San Ramón (Bolaños and Ehmcke 1996), Rincón de Osa on the Corcovado Peninsula (Scott 1976), and San Vito in the Fila Costeña (Santos-Barrera et al. 2008), other areas of the country have received less attention. We report the results of a weeklong survey of the Nectandra Reserve, in Alajuela province. This was the first study of the herpetofauna of the reserve.

## MATERIALS AND METHODS

### Study site

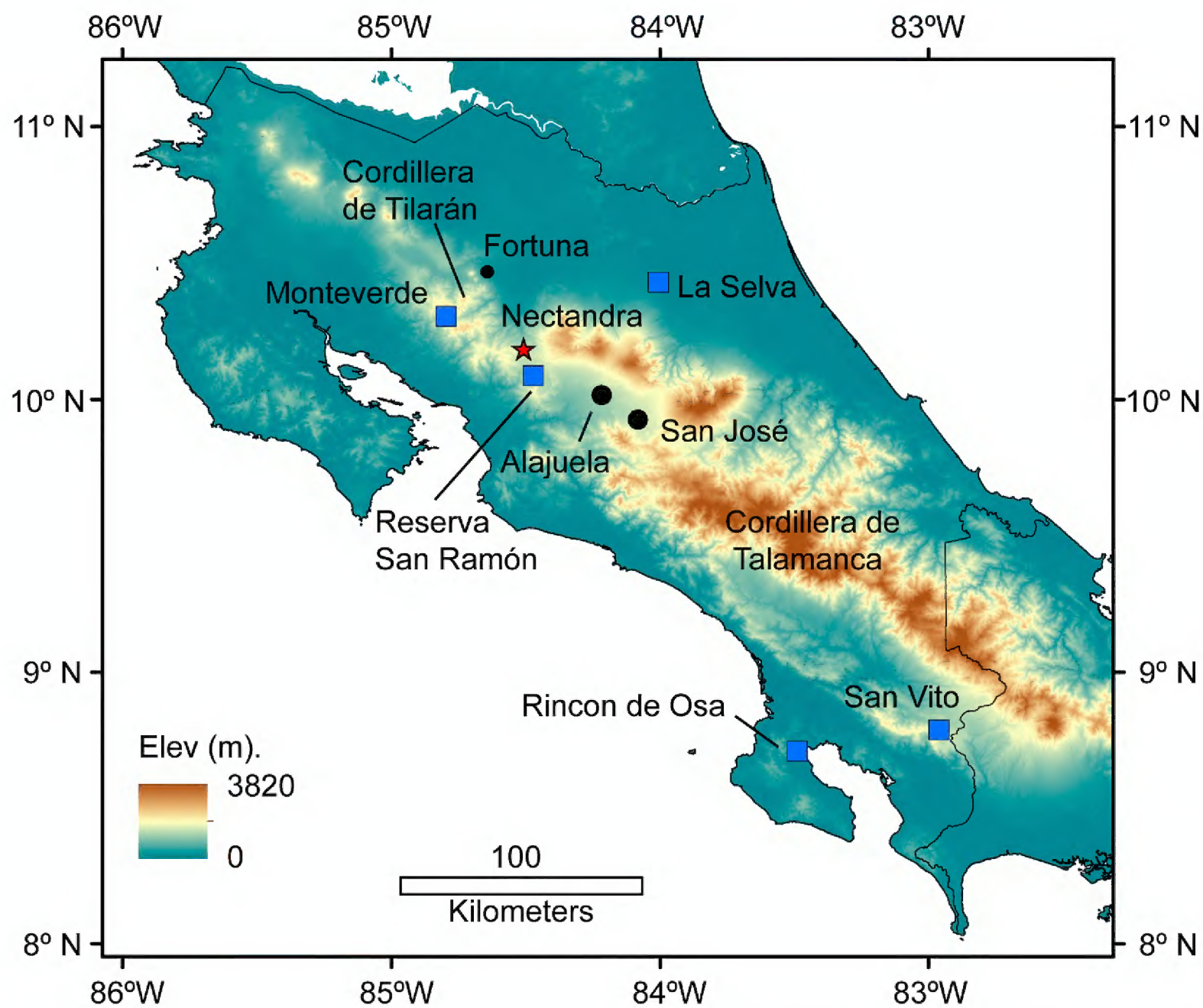
The Nectandra Reserve is located north of San Ramón on the highway to Fortuna (10.18564° N, 084.50787°W,

WGS84 datum), across the continental divide from the well-known Monteverde Cloud Forest Reserve (Figure 1) in the Province of Alajuela, Costa Rica. The reserve is east of the continental divide (Caribbean drainage) in the southeast portion of the Cordillera de Tilarán, and has an extent of 130 ha. Elevations on the reserve range from approximately 1,000–1,200 m, and the forest is classified as premontane rainforest (Holdridge 1967). Within or immediately adjacent to the reserve, habitats include primary forest, secondary forest, abandoned cacao plantation, and cattle pasture. The reserve contains several streams as well as some small man-made ponds adjacent to the entrance.

### Data collection

We conducted a first survey of the Nectandra Reserve from 10–16 June 2010 in order to document the herpetofauna of the reserve and establish a baseline for future biological work and management. The survey was conducted during the rainy season, when amphibian species are most active. From 10–14 June, all authors were involved in survey work, with help from one local guide at all times, while only the first author (S. Rovito) conducted surveys from 15–16 June. We surveyed opportunistically by walking trails during the day and searching for amphibians and reptiles on vegetation, under logs, in leaf litter, and along streams. We also walked along the highway that borders the reserve to the east in order to collect road-killed snakes. By night, we searched along trails and streams with headlamps. We estimate that we searched for 4–6 hours each day and 1–3 hours per night. Because no herpetological collection yet exists from the reserve, we collected up to three specimens of each species. A permit for specimen collection was issued by MINAET (089 2010-SINAC). Amphibians and reptiles were euthanized using standard





**Figure 1.** Map of Costa Rica, showing locations of areas discussed in the text where amphibian and reptile surveys have been conducted (blue squares). Nectandra is indicated by a red star.

methods, preserved in 10% buffered formalin and stored in 95% ethanol. Tissues of each specimen were collected in RNAlater for future genetic analyses. All specimens and tissues were deposited in the herpetological collection of the Museo de Zoología, Universidad de Costa Rica (Tables 1 and 2 for specimen numbers). Species identifications were assigned in the field using keys and information provided in Savage (2002), Köhler (2008), and Köhler (2011) and confirmed or updated by Federico Bolaños (Universidad de Costa Rica). We followed the taxonomy of AmphibiaWeb (2014) for all amphibian species identifications and that of Köhler (2008) for reptile species.

## RESULTS

We found a total of 30 amphibian and reptile species on or adjacent to the Nectandra Reserve. These included 15 frogs, 2 salamanders, 7 lizards, and 6 snakes (Tables 1 and 2; Figures 1–3). The most abundant amphibian species were direct-developing frogs of the families Craugastoridae, Eleutherodactylidae, and Strabomantidae, especially *Craugastor bransfordii* (Cope, 1886), *C. crassidigitus* (Taylor, 1952), *C. fitzingeri* (Schmidt, 1857), *Diasporus hylaeformis* (Cope, 1875), and *Pristimantis cruentus* (Peters, 1873). Near riparian areas, *Espadarana prosoblepon* (Boettger, 1892) was extremely common. We also found several *Anolis* species in abundance, including

**Table 1.** Amphibian species found in the Nectandra Cloud Forest Reserve, and associated voucher numbers for specimens deposited at the University of Costa Rica.

Family	Species	Taxonomic authority	Voucher number
Bufonidae	<i>Incilius coniferus</i>	(Cope, 1862)	UCR 20974
Centrolenidae	<i>Espadarana prosoblepon</i>	(Boettger, 1892)	UCR 20938, 20958, 20973
	<i>Teratohyla pulverata</i>	(Peters, 1973)	UCR 20954
Craugastoridae	<i>Craugastor bransfordii</i>	(Cope, 1886)	UCR 20948, 20951, 20978
	<i>Craugastor crassidigitus</i>	(Taylor, 1952)	UCR 20942, 20949
	<i>Craugastor fitzingeri</i>	(Schmidt, 1857)	UCR 20940, 20963, 20979
Eleutherodactylidae	<i>Diasporus diastema</i>	(Cope, 1875)	UCR 20943
	<i>Diasporus hylaeformis</i>	(Cope, 1875)	UCR 20939, 20955
Hylidae	<i>Duellmanohyla rufoculis</i>	(Taylor, 1952)	UCR 20962
	<i>Isthmohyla pseudopuma</i>	(Günther, 1901)	UCR 20947, 20965
	<i>Scinax elaeochroa</i>	(Cope, 1875)	no voucher
	<i>Smilisca phaeota</i>	(Cope, 1862)	UCR 20967, 20968
	<i>Rana warszewitschii</i>	(Schmidt, 1857)	UCR 20936, 20937
Strabomantidae	<i>Pristimantis cruentus</i>	(Peters, 1873)	UCR 20952, 20960, 20987
	<i>Pristimantis ridens</i>	(Cope, 1866)	UCR 20951
Plethodontidae	<i>Nototriton gamezi</i>	García-París & Wake, 2000	UCR 20969
	<i>Oedipina uniformis</i>	Keferstein, 1868	UCR 20982



*Anolis capito* Peters, 1863, *A. humilis* Peters, 1863, *A. limifrons* Cope, 1862, and *A. oxylophus* Cope, 1876 (the latter always along streams). *Atropoides* sp. [*Atropoides mexicanus* (Duméril, Bibron, & Duméril, 1854) and perhaps *A. picadoi* (Dunn, 1939)] was commonly encountered along paths, and *Ninia maculata* (Peters, 1861) and *Rhadinea decorata* (Günther, 1858) were found to be common as well. All other species were represented in the survey by only one to a few individuals.

DISCUSSION

The amphibians and reptiles that we found mainly represent a subset of those known from the more extensively surveyed Reserva Biológica Alberto ML Brenes, San Ramón (hereafter Reserva San Ramón). Bolaños and Ehmcke (1996) reported 30 amphibian and 35 reptile species from the Reserva San Ramón. They listed as common the same species of direct developing terrestrial frogs and *Anolis* that we found to be abundant at Nectandra. Their list includes a number of species that we did not find, including frogs such as *Atelopus varius* (Lichtenstein & Martens, 1856) and *Craugastor andi* (Savage, 1974) that have experienced severe declines and extirpations (Pounds and Crump 1994; Pounds et al. 1997). Bolaños and Ehmcke (1996) list *Craugastor crassidigitus* as uncommon and in decline, while we found it to be

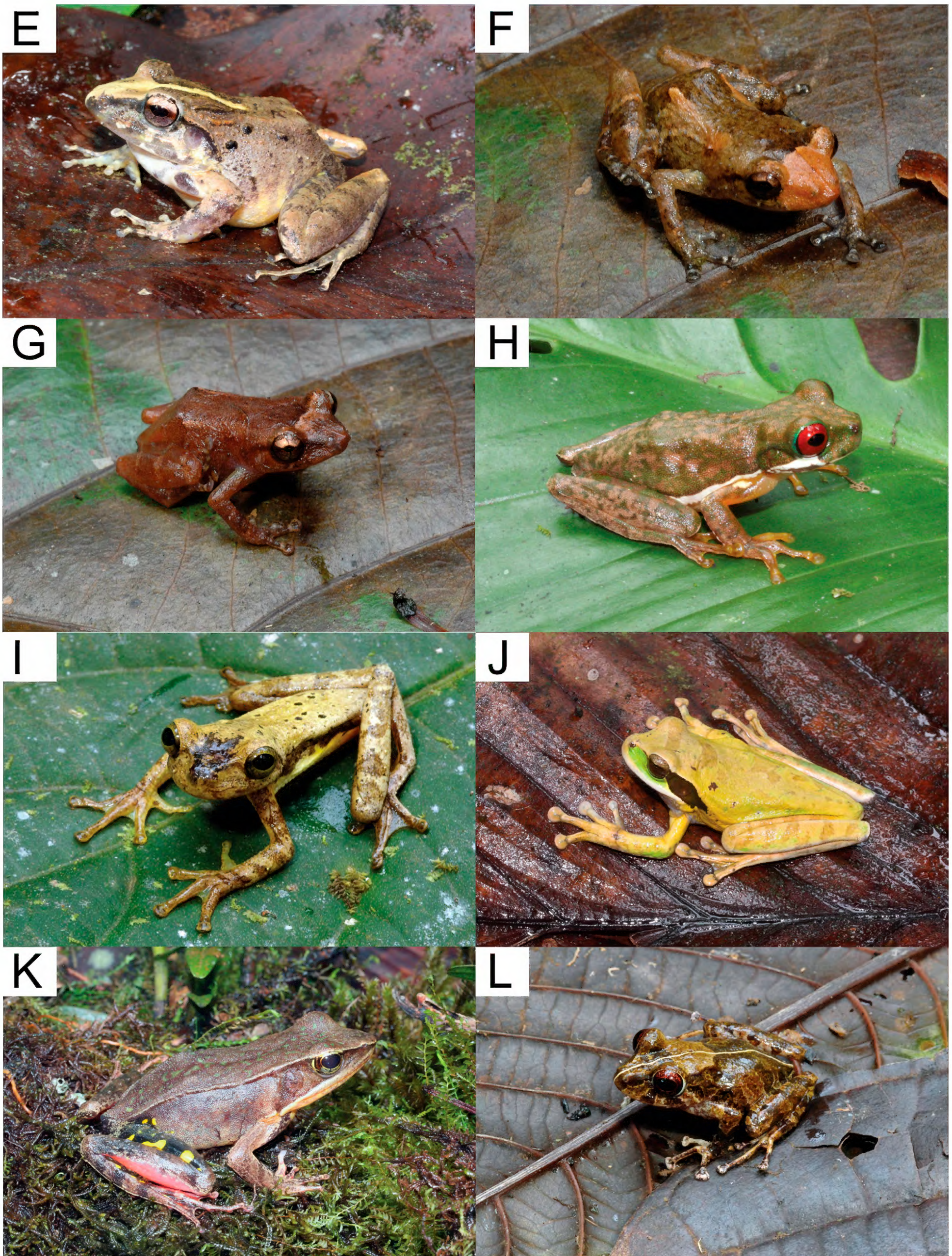
**Table 2.** Reptile species found in the Nectandra Cloud Forest Reserve, and associated voucher numbers for specimens deposited at the University of Costa Rica.

Family	Species	Taxonomic authority	Voucher number
Anguidae	<i>Diploglossus bilobatus</i>	(O’Shaughnessy, 1874)	UCR 20970, 20991
Gekkonidae	<i>Lepidoblepharis xanthostigma</i>	(Noble, 1916)	UCR 20980, 20989, 20990
Gymnophthalmidae	<i>Ptychoglossus plicatus</i>	(Taylor, 1949)	UCR 20981
Polychrotidae	<i>Anolis biporcatus</i>	(Wiegmann, 1834)	UCR 20966
	<i>Anolis capito</i>	Peters, 1863	UCR 20946, 20961
	<i>Anolis humilis</i>	Peters, 1863	UCR 20953, 20964
	<i>Anolis limifrons</i>	Cope, 1862	UCR 20944, 20955
	<i>Anolis oxylophus</i>	Cope, 1876	UCR 20959, 20972, 20986
Colubridae	<i>Ninia maculata</i>	(Peters, 1861)	UCR 20957, 20975, 20983
	<i>Rhadinea decorata</i>	(Günther, 1858)	UCR 20976, 20977, 20988
	<i>Sibon annulatus</i>	(Günther, 1872)	UCR 20950
Elapidae	<i>Micrurus nigrocinctus</i>	(Girard, 1854)	UCR 20971, 20984, 20985
Viperidae	<i>Atropoides mexicanus</i>	(Duméril, Bibron & Duméril 1854)	UCR 20956
	<i>Bothrops asper</i>	(Garman, 1883)	photo only



**Figure 2.** Species of amphibians found at Nectandra. **A)** *Incilius coniferus*, UCR 30974; **B)** *Espadarana prosoblepon*, UCR 20938; **C)** *Teratohyla pulverata*, UCR 20954; **D)** *Craugastor crassidigitus*, UCR 20949. Photos A and C by SMR, others by TJD.









**Figure 2.** Continued. **M)** *Pristimantis ridens*, UCR 20941; **N)** *Nototriton gamezi*, UCR 20969; **O)** *Oedipina uniformis*, UCR 20982. Photo O by SMR, others by TJD.

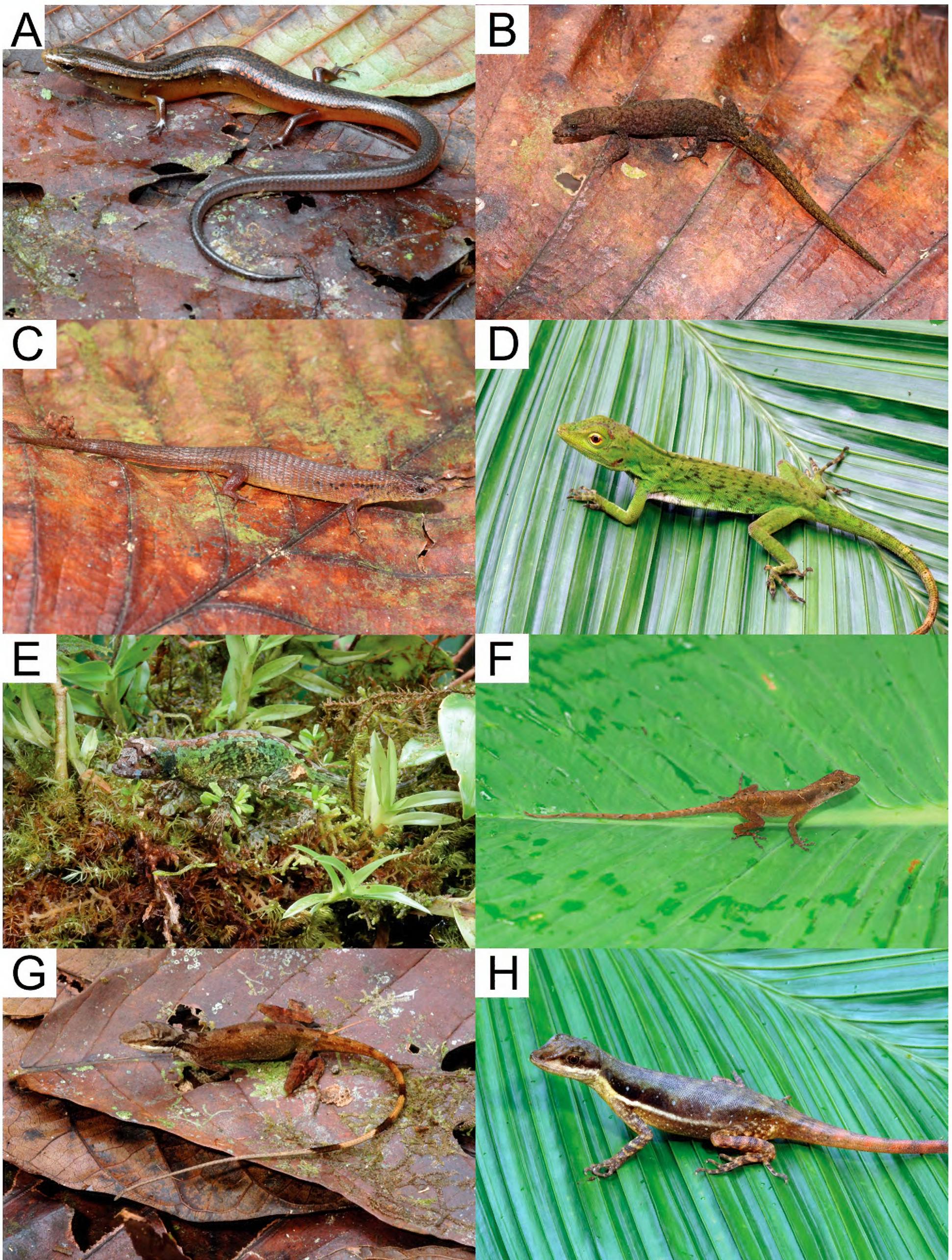
relatively common. They also reported species, such as *Ecnomihyla miliaria* (Cope, 1886) and *Anotheca spinosa* (Steindachner, 1864) that are difficult to detect and may be present at Nectandra but would not be expected to be found during a short survey. One notable species we found at Nectandra is the salamander *Nototriton gamezi* García-París & Wake 2000. This species is known from only two localities in Costa Rica: the type locality in the Monteverde Cloud Forest Reserva (García-París and Wake 2000) and the Reserva San Ramón (reported as *N. abscondens* by Bolaños and Ehmcke (1996)). The Nectandra Reserve is located between these two reserves, and adds a third known site to the distribution on this narrowly endemic species. We found three species of amphibians (*Isthmohyla pseudopuma*, *Oedipina uniformis*, *Teratohyla pulverata*) and one species of reptile (*Lepidoblepharis xanthostigma*) that were not reported by Bolaños and Ehmcke (1996).

The survey of the Reserva San Ramón was conducted at elevations of 800–1,200 m, approximately the same altitudinal range as our survey of Nectandra. Because of the close geographic proximity of the two reserves and their similarity in habitats and elevation, we expect the list of amphibians and reptiles from Nectandra will more closely resemble the more complete list from the Reserva San Ramón if more extensive fieldwork were to take place at Nectandra.

From our interviews of the staff of Nectandra, we can add several species of probable occurrence that were not found during our survey. These include eight snakes [*Bothriechis schlegelii* (Berthold, 1846); *Bothriechis lateralis* Peters, 1862; *Bothriechis nigroviridis* Peters, 1859, *Drymobius margaritiferus* (Schlegel, 1837); *Imantodes cenchoa* (Linnaeus, 1758); *Leptophis* sp. (Bell, 1825); *Liophis epinephalus* Cope, 1862a; *Oxybelis* sp. Wagler, 1830], two lizards [*Ameiva festiva* (Lichtenstein & von Martens, 1856); *Anolis insignis* Cope, 1871], and one frog [*Rhinella marina* (Linnaeus, 1758)]. Additionally, we collected only a single *Atropoides* (found dead on a road) and did not identify other individuals to species level. It is sometimes necessary to count ventrals and examine loreal scales to distinguish *A. mexicanus* from the sympatric *Atropoides picadoi* (Dunn, 1939) (Savage 2002); thus, *A. picadoi* may also be present at Nectandra.

The relatively large number of species of amphibians and reptiles found at Nectandra, including several not reported from a previous survey of the Reserva San Ramón, shows that Nectandra is an important component of the system of protected areas linking the Cordillera de Tilarán and the Cordillera Central of Costa Rica. Amphibian declines have been reported at sites in both of these regions (including Monteverde and the Reserva San Ramón) and having current information on amphibian populations at other sites is important for





**Figure 3.** Species of lizards found at Nectandra. **A)** *Diploglossus bilobatus*, UCR 20970; **B)** *Lepidoblepharis xanthostigma*, UCR 20980; **C)** *Ptychoglossus plicatus*, UCR 20981; **D)** *Anolis biporcatus*, UCR 20966; **E)** *Anolis capito*, UCR 20946; **F)** *Anolis humilis*, UCR 20964; **G)** *Anolis limifrons*, UCR 20944; **H)** *Anolis oxylophus*, UCR 20972. Photos B, C, F by SMR, others by TJD.





**Figure 4.** Species of snakes found at Nectandra. **A)** *Ninia maculata*, UCR 20957; **B)** *Rhadinea decorata*, UCR 20976; **C)** *Sibon annulatus*, UCR 20950; **D, E)** *Atropoides* sp., not collected; **F)** *Bothrops asper*, not collected. Photos B, F by TJD, others by SMR.

understanding these declines in a regional and temporal context. The elevation of Nectandra places it in the same range as sites where major amphibian declines have occurred in Costa Rica (Pounds and Crump 1994; Young et al. 2001), and the results of this survey can be used as an additional reference for the status of post-decline amphibian populations. Nectandra is a site that could be used in plans for the recovery of surviving species that suffered declines. Additional surveys of the herpetofauna of Nectandra should be conducted in order to find rare or elusive species that were not seen during our short survey. The reserve also represents a promising site for scientific research and public outreach efforts, given its easy access and high biological diversity.

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